1.7 Drawings and Other Detailed Information

The figures referenced in subsections 1.7.1 and 1.7.2 may represent a functional diagram, general structural representation, or another general illustration. For instrumentation and control (I&C) systems, figures may also represent aspects of the relevant logic of the system or part of the system. Unless specified explicitly, the figures are not indicative of the scale, location, dimensions, shape, or spatial relationships of as-built structures, systems, and components. In particular, the as-built attributes of structures, systems, and components may vary from the attributes depicted on the figures, provided that those safety functions discussed in the design description pertaining to the figure are not adversely affected.

1.7.1 Electrical and Instrumentation and Control Drawings

Instrument and control functional diagrams, electrical one-line diagrams, and onsite standby diesel generator loading sequence and initiating circuit logic diagrams are listed in Table 1.7-1.

The legend for electrical power, control, lighting, and communication drawings is provided in Figure 1.7-1, sheets 1, 2, and 3. The index, notes, and symbols for instrument and control functional diagrams are provided in Figure 7.2-1.

1.7.2 Piping and Instrumentation Diagrams

Table 1.7-2 contains a list of piping and instrumentation diagrams (P&IDs) and the corresponding DCD figure numbers. The three letter system names are provided in Table 1.7-2. Figures appear at the end of the respective text section. The P&ID legend, Figure 1.7-2, sheets 1, 2, and 3, provides an explanation of AP1000 symbols and characters used in these DCD figures.

1.7.3 Combined License Information

This section has no requirement for additional information to be provided in support of the combined license application.

Table 1.7-1

I&C FUNCTIONAL AND ELECTRICAL ONE-LINE DIAGRAMS

DCD Figure Number	Title
7.2-1 (Sheet 1)	Index and Symbols
7.2-1 (Sheet 2)	Reactor Trip Function
7.2-1 (Sheet 3)	Nuclear Startup Protection
7.2-1 (Sheet 4)	Nuclear Overpower Protection
7.2-1 (Sheet 5)	Core Heat Removal Protection and Reactor Coolant Pump Trip
7.2-1 (Sheet 6)	Primary Overpressure & Loss of Heat Sink Protection
7.2-1 (Sheet 7)	Loss of Heat Sink Protection
7.2-1 (Sheet 8)	Loss of Heat Sink Protection
7.2-1 (Sheet 9)	Steam Line Isolation
7.2-1 (Sheet 10)	Feedwater Isolation
7.2-1 (Sheet 11)	Safeguards Actuation
7.2-1 (Sheet 12)	Core Makeup Tank Actuation
7.2-1 (Sheet 13)	Containment and Other Protection
7.2-1 (Sheet 14)	Turbine Trip
7.2-1 (Sheet 15)	Automatic RCS Overpressurization Valve Sequencing
7.2-1 (Sheet 16)	Incontainment Refueling Water Storage Tank Actuations
7.2-1 (Sheet 17)	Passive Residual Heat Removal and Core Makeup Tank Isolation Valve Interlocks
7.2-1 (Sheet 18)	Normal Residual Heat Removal System Isolation Valve Interlocks
7.2-1 (Sheet 19)	Containment Vacuum Relief Protection
7.2-1 (Sheet 20)	Diverse Actuation System Logic, Automatic Actuations
7.2-1 (Sheet 21)	Diverse Actuation System Logic, Manual Actuations
8.3.1-1	AC Power System - Station One-Line Diagram (Sheets 1 & 2)
8.3.1-2	On-site Standby Diesel Generator Initiation Circuit Logic Diagram
8.3.1-3	Post 72 Hours Temporary Electric Power One Line Diagram
8.3.2-1	Class 1E DC System One-Line Diagrams (Sheets 1 & 2)
8.3.2-2	Class 1E 208Y/120V UPS One-Line Diagram
8.3.2-3	Non-Class 1E DC & UPS System One-Line Diagrams (Sheets 1, 2 & 3)

Table 1.7-2 (Sheet 1 of 3)

AP1000 SYSTEM DESIGNATORS AND SYSTEM DIAGRAMS

Designator	System (Note 1)	DCD Section	DCD Figure (Note 2)
ASS	Auxiliary Steam Supply System	10.4.10	None
BDS	Steam Generator Blowdown System	10.4.8	10.4.8-1
CAS	Compressed and Instrument Air Systems	9.3.1	9.3.1-1
CCS	Component Cooling Water System	9.2.2	9.2.2-2
CDS	Condensate System	10.4.7	10.4.7-1
CES	Condenser Tube Cleaning System	10.4.1.2.1, 10.4.5.2.3	None
CFS	Turbine Island Chemical Feed System	10.4.11	None
CMS	Condenser Air Removal System	10.4.2	None
CNS	Containment System	6.2.3	None
CPS	Condensate Polishing System	10.4.6	10.4.6-1
CVS	Chemical and Volume Control System	9.3.6	9.3.6-1
CWS	Circulating Water System (Partially out of scope)	10.4.5	None
DAS	Diverse Actuation System	7.7	7.2-1 (Sh. 19 & 20)
DDS	Data Display and Processing System	7.1 & 7.7	7.1-1
DOS	Standby Diesel Fuel Oil System	9.5.4	9.5.4-1
DRS	Storm Drain System (Wholly out of scope)	None	None
DTS	Demineralized Water Treatment System	9.2.3	None
DWS	Demineralized Water Transfer and Storage System	9.2.4	9.2.4-1
ECS	Main ac Power System	8.3.1	8.3.1-1
EDS	Non Class 1E dc and UPS System	8.3.2	8.3.2-3
EFS	Communication Systems	9.5.2	None
EGS	Grounding and Lightning Protection System	8.3.1.1	None
EHS	Special Process Heat Tracing System	8.3.1.1	None
ELS	Plant Lighting System	9.5.3	None
EQS	Cathodic Protection System (Partially out of scope)	None	None
FHS	Fuel Handling and Refueling System	9.1.1, 9.1.2, 9.1.4	9.1 - various
FPS	Fire Protection System	9.5.1, 6.5.2	9.5.1-1
FWS	Main and Startup Feedwater System	10.4.7, 10.4.9	10.4.7-1
GSS	Gland Seal System	10.4.3	10.4.3-1
HCS	Generator Hydrogen and CO_2 Systems	10.2	None
HDS	Heater Drain System	10.4.7	None
HSS	Hydrogen Seal Oil System	10.2	None
IDS	Class 1E dc and UPS System	8.3.2	8.3.2-1
IIS	In-core Instrumentation System	4.4.6	None

Table 1.7-2 (Sheet 2 of 3)

AP1000 SYSTEM DESIGNATORS AND SYSTEM DIAGRAMS

Designator	System (Note 1)	DCD Section	DCD Figure (Note 2)
LOS	Main Turbine and Generator Lube Oil System	10.2	None
MES	Meteorological and Environmental Monitoring System (Wholly out of scope)	2.3.3	None
MHS	Mechanical Handling System	9.1	None
MSS	Main Steam System	10.3	10.3.2-2
MTS	Main Turbine System	10.2	10.2-1
OCS	Operation and Control Centers System	7.1, Ch. 18	7.1-1
PCS	Passive Containment Cooling System	6.2.2	6.2.2-1
PGS	Plant Gas Systems	9.3.2	None
PLS	Plant Control System	7.1 & 7.7	7.1-1
PMS	Protection and Safety Monitoring System	Ch. 7	7.2-1
PSS	Primary Sampling System	9.3.3	9.3.3-1
PWS	Potable Water System (Partially out of scope)	9.2.5	None
PXS	Passive Core Cooling System	6.3	6.3-1
RCS	Reactor Coolant System	5.1	5.1-5
RDS	Gravity and Roof Drain Collection System (Partially out of scope)	None	None
RMS	Radiation Monitoring System	11.5	None
RNS	Normal Residual Heat Removal System	5.4.7	5.4-7
RWS	Raw Water System (Wholly out of scope)	9.2.1.2.2, 9.2.1.2.3.1, 9.2.3, 9.2.5	None
RXS	Reactor System	3.9.4, 3.9.5, 4.2.2.2, 4.2.2.3.1, 5.3	5.3-1
SDS	Sanitary Drainage System (Partially out of scope)	9.2.6	None
SES	Plant Security System (Partially out of scope)	13.6	None
SFS	Spent Fuel Pit Cooling System	9.1.3	9.1-6
SGS	Steam Generator System	10.3, 10.4.7, 10.4.9	10.3.2-1
SJS	Seismic Monitoring System	3.7.4	None
SMS	Special Monitoring System	4.4.6.4	None
SSS	Secondary Sampling System	9.3.4	None
SWS	Service Water System	9.2.1	9.2.1-1
TCS	Turbine Building Closed Cooling Water System	9.2.8	None

Table 1.7-2 (Sheet 3 of 3)

AP1000 SYSTEM DESIGNATORS AND SYSTEM DIAGRAMS

Designator	System (Note 1)	DCD Section	DCD Figure (Note 2)
TDS	Turbine Island Vents, Drains and Relief System	9.2.9.2.2, 10.4.2.2.1, 10.4.3.1.2, 10.4.3.2.2, 10.4.6.3	None
TOS	Main Turbine Control and Diagnostics System	10.2.2.4	None
TVS	Closed Circuit TV System (Wholly out of scope)	None	None
VAS	Radiologically Controlled Area Ventilation System	9.4.3	9.4.3-1
VBS	Nuclear Island Nonradioactive Ventilation System	9.4.1	9.4.1-1
VCS	Containment Recirculation Cooling System	9.4.6	9.4.6-1
VES	Main Control Room Emergency Habitability System	6.4	6.4-2
VFS	Containment Air Filtration System	9.4.7	9.4.7-1
VHS	Health Physics and Hot Machine Shop HVAC System	9.4.11	9.4.11-1
VLS	Containment Hydrogen Control System	6.2.4	6.2.4 - various
VRS	Radwaste Building HVAC System	9.4.8	9.4.8-1
VTS	Turbine Building Ventilation System	9.4.9	9.4.9-1
VUS	Containment Leak Rate Test System	6.2.5	6.2.5-1
VWS	Central Chilled Water System	9.2.7	9.2.7-1
VXS	Annex/Auxiliary Non-Radioactive Ventilation System	9.4.2	9.4.2-1
VYS	Hot Water Heating System	9.2.10	None
VZS	Diesel Generator Building Ventilation System	9.4.10	9.4.10-1
WGS	Gaseous Radwaste System	11.3	11.3-2
WLS	Liquid Radwaste System	11.2	11.2-2
WRS	Radioactive Waste Drain System	9.3.5, 11.2	9.3.5-1
WSS	Solid Radwaste System	11.4	11.4-1
WWS	Waste Water System (Partially out of scope)	9.2.9	None
YFS	Yard Fire Water System (Wholly out of scope)	None	None
ZAS	Main Generation System (Note 3)	8.1	None
ZBS	Transmission Switchyard and Offsite Power System (Wholly out of scope)	8.2	None
ZOS	Onsite Standby Power System	8.2.1, 8.3.1	8.3.1-4, 8.3.1-5
ZRS	Offsite Retail Power System (Wholly out of scope)	None	None
ZVS	Excitation and Voltage Regulation System	10.2.2.3	None

Notes:

1. For the System names:
   a) An entry with the system name only means the system is wholly in the scope of the AP1000 design certification.
   b) An entry with the system name followed by (Partially out of scope) means the system is partially in the scope of the AP1000 design certification.
   c) An entry with the system name followed by (Wholly out of scope) means the system is not in the scope of the AP1000 design certification.

2. For the DCD Figures:
   In the AP1000 design documentation system, Piping and Instrumentation Diagrams are numbered xxx-M6-yyy, where xxx is the system designator and yyy is the sheet number. Electrical One-Line Diagrams are numbered xxx-E3-yyy, where xxx is the system designator and yyy is the sheet number. I&C Functional Logic Diagrams are numbered xxx-J1-yyy, where xxx is the I&C system designator and yyy is the sheet number.

3. For the Main Generation System:
   The high side voltage of the main step-up transformer and the reserve auxiliary transformer is site specific.

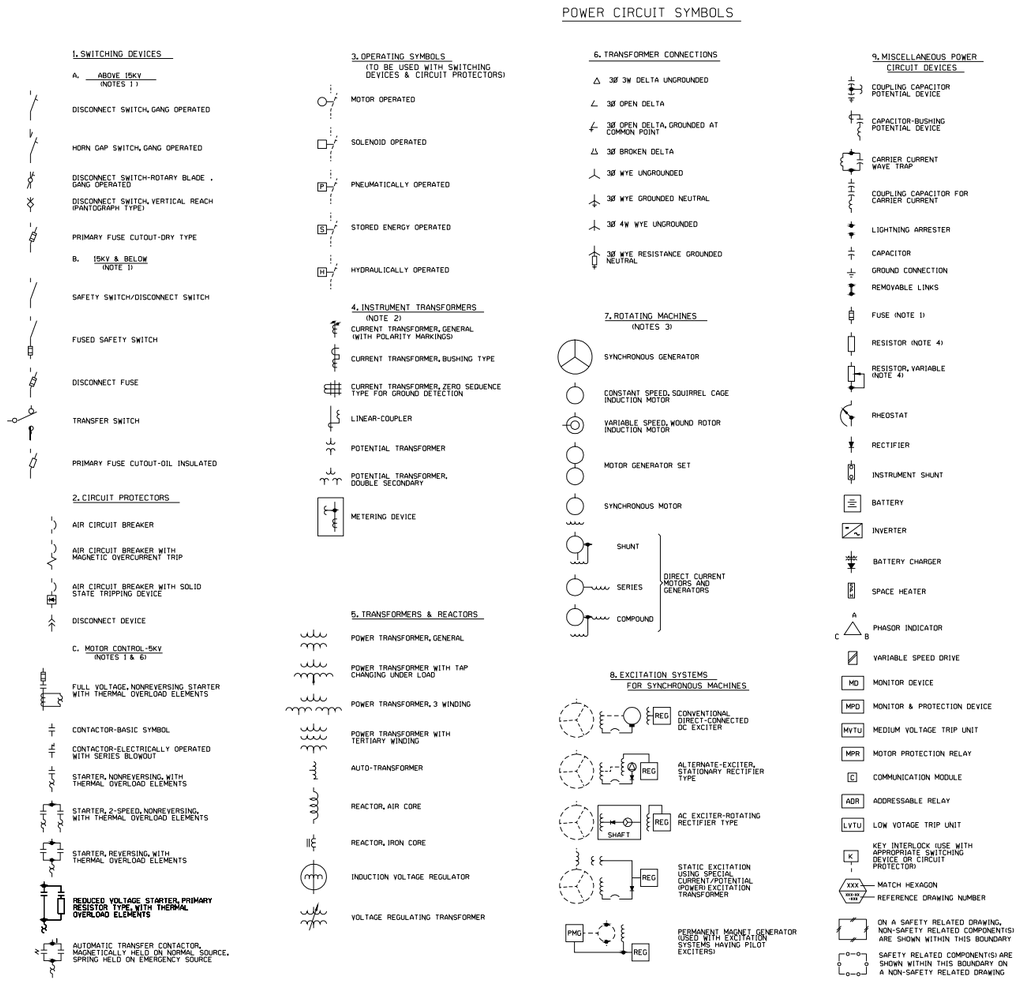


Figure 1.7-1 (Sheet 1 of 3)

Legend for Electrical Power, Lighting, and Communication Drawings

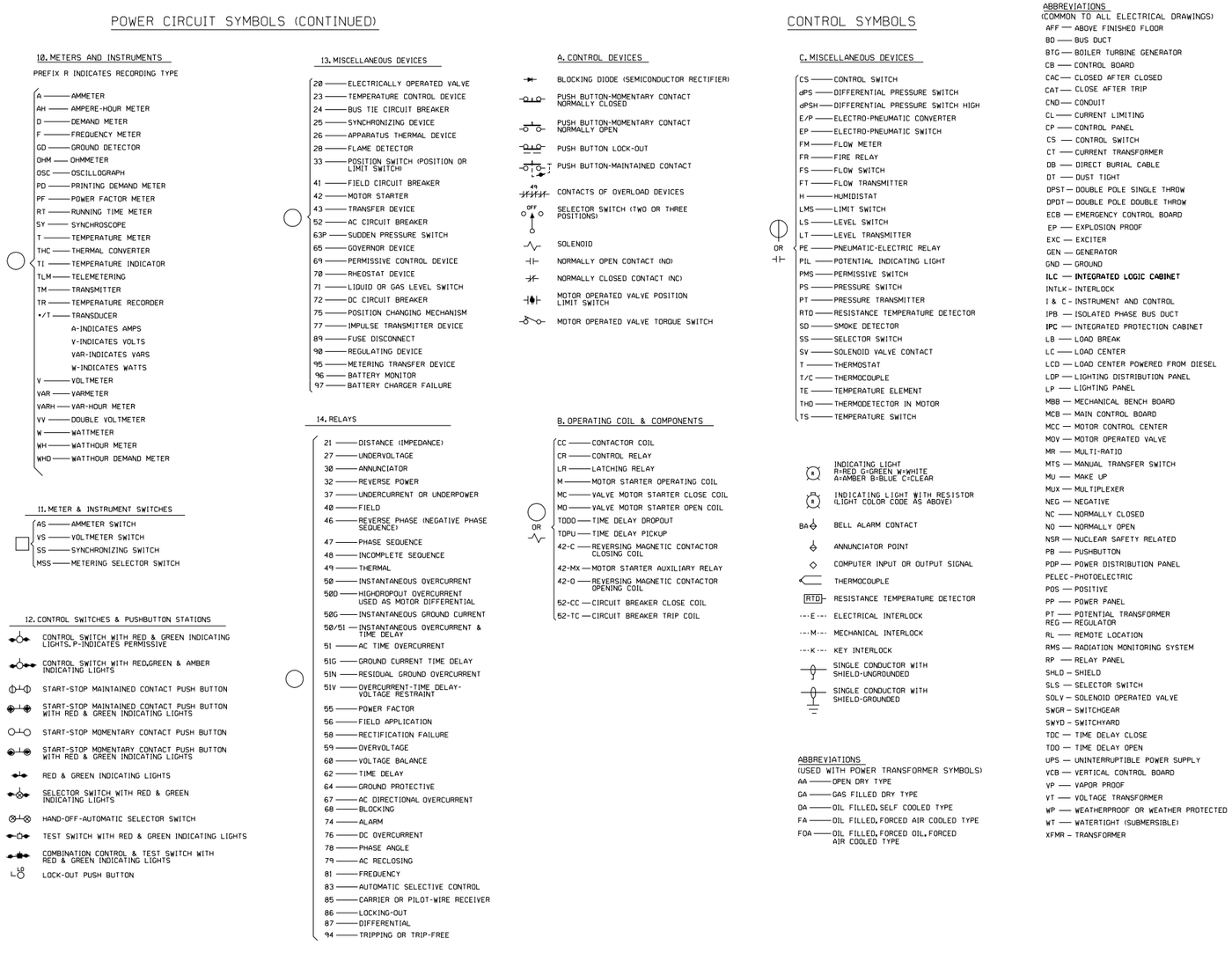


Figure 1.7-1 (Sheet 2 of 3)

Legend for Electrical Power, Lighting, and Communication Drawings

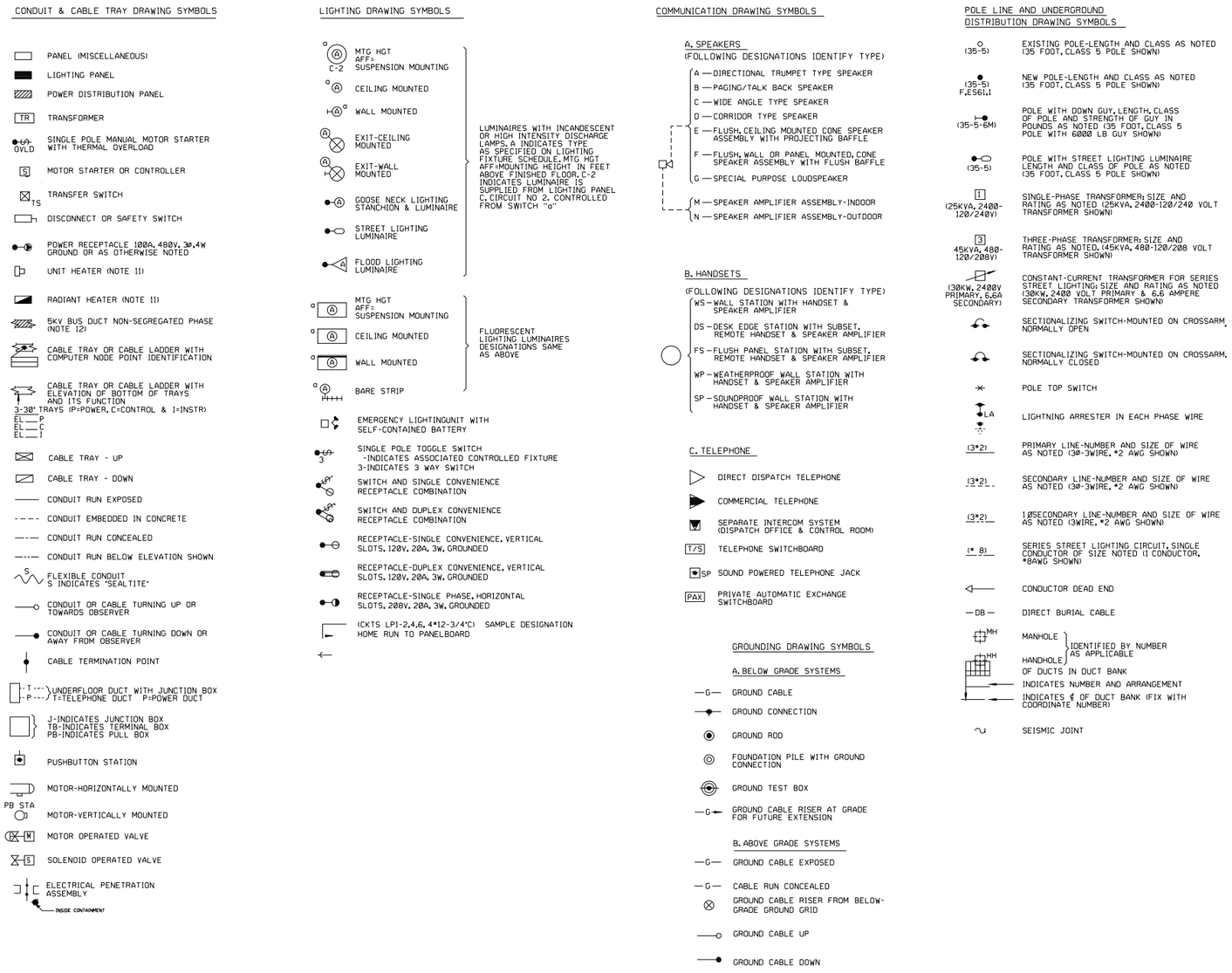


Figure 1.7-1 (Sheet 3 of 3)

Legend for Electrical Power, Lighting, and Communication Drawings

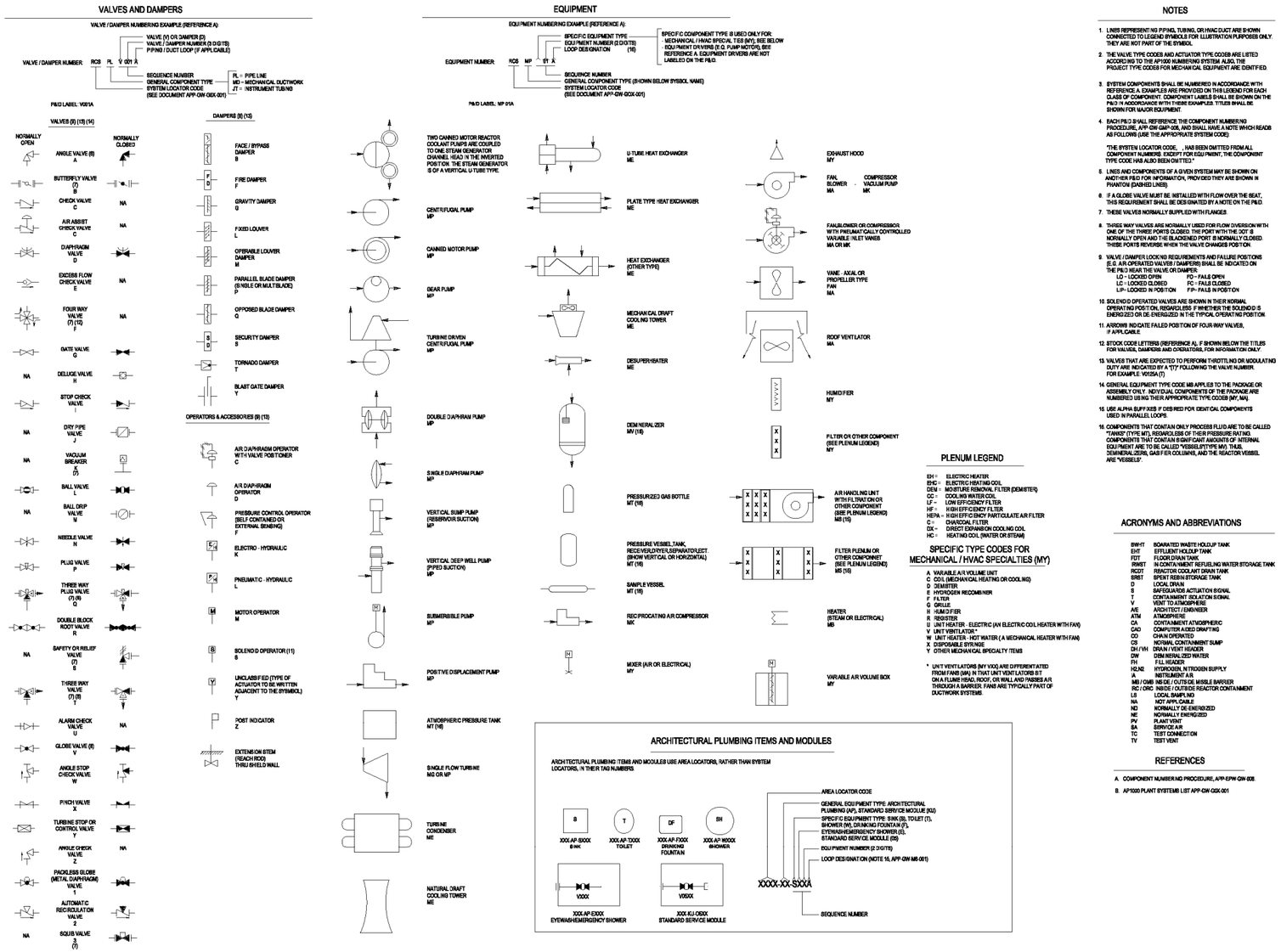
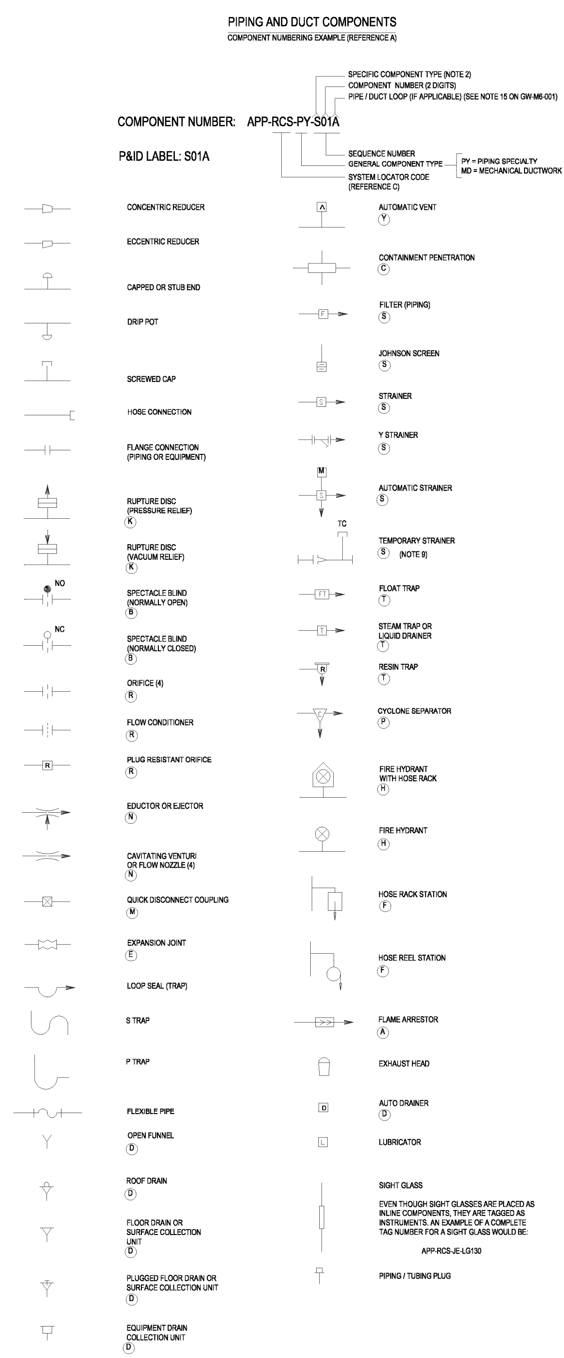
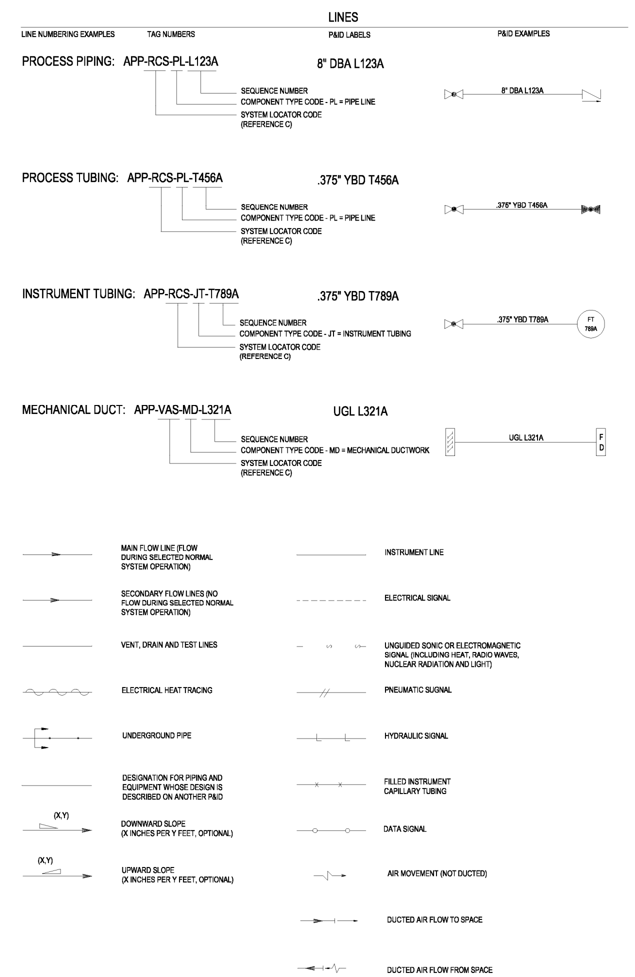
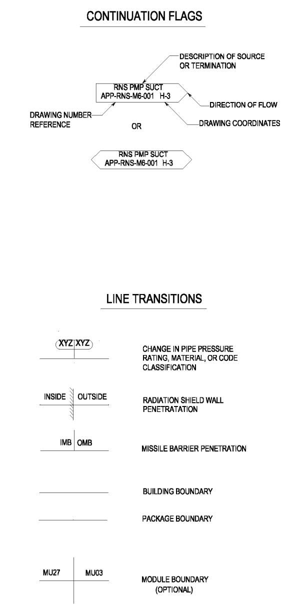


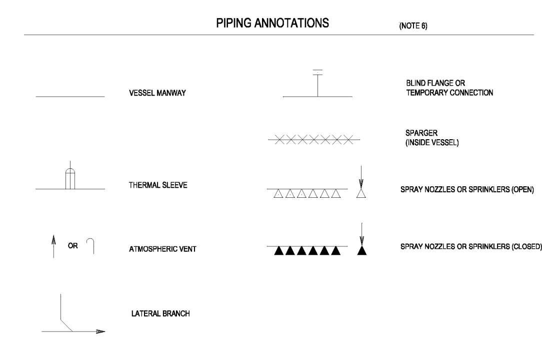
Figure 1.7-2 (Sheet 1 of 3)

Piping and Instrumentation Diagram Legend



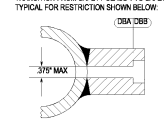






NOTES:

1. FOR GENERAL NOTES SEE LEGEND DRAWING APP-GW-M6-001
2. IF APPLICABLE, CODE LETTERS FOR SPECIFIC COMPONENT TYPE (REFERENCE A) ARE SHOWN BELOW THE NAME OF THE SYMBOL.
3. IN GENERAL, PIPING AND DUCT COMPONENTS WILL NOT BE LABELED ON THE P&ID, UNLESS SPECIFIC IDENTIFICATION IS REQUIRED FOR MAINTENANCE, OPERATION OR TEST PURPOSES. COMPONENTS TO BE LABELLED ON THE P&ID ARE IDENTIFIED BY A CIRCLE AROUND THE CODE LETTER FOR SPECIFIC COMPONENT TYPE.
4. ORIFICES AND FLOW NOZZLES WHICH ARE USED FOR FLOW MEASUREMENT SHALL BE NUMBERED AND LABELED AS INSTRUMENTS (FLOW ELEMENTS) IN ACCORDANCE WITH DRAWING APP-GW-M6-003.
5. CONTINUATION FLAGS SHALL BE USED TO SHOW INTERFACES BETWEEN P&IDS. SYSTEM INTERFACES SHALL ALWAYS BE REPRESENTED BY CONTINUATION FLAGS.
6. ANNOTATIONS ARE GRAPHICS ONLY. NO ELECTRONIC DATA IS ASSOCIATED WITH ANNOTATIONS.
7. IN SAFETY CLASS I PIPING AND EQUIPMENT, A FLOW RESTRICTION IS REQUIRED IN 1 (ONE) INCH PIPING TO ALLOW TRANSITION FROM SAFETY CLASS 1 TO SAFETY CLASS 2. TYPICAL FOR RESTRICTION SHOWN BELOW:



8. INSTRUMENT TUBING (COMPONENT TYPE JT) IS BETWEEN THE INSTRUMENT ROOT VALVE AND THE TRANSMITTER. THE INSTRUMENT ROOT VALVE AND PIPING TO THE PROCESS LINE ARE COMPONENT TYPE CODE "PL".
9. TEMPORARY STRAINER TEST CONNECTION IS LOCATED ON PUMP SIDE OF THE STRAINER.

REFERENCES:

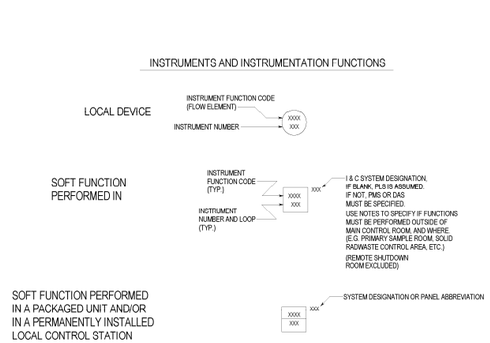
A. AP1000 COMPONENT NUMBERING PROCEDURE. APP-GW-GMP-006.
B. P& ID LEGEND DRAWING, APP-GW-M6-001.
C. AP1000 PLANT SYSTEM LIST, APP-GW-G0X-001.

LINE AND VALVE / DAMPER SPECIFICATIONS

CODE	NOMINAL PRESSURE RATING (FIRST LETTER)	BASIC PIPE LINE MATERIAL (SECOND LETTER)	DESIGN CODE / STANDARD (THIRD LETTER)
A	CL 2500 ASME B16.5	ALLOY STEEL, STANDARD	ASME SEC.III, CLASS 1, NRC QUAL. GRP. A
B	SPECIAL RATING - SEE CLASS SHEET	AUSTENTIC STAINLESS STEEL, STANDARD	ASME SEC.III, CLASS 2, NRC QUAL. GRP. B
C	CL 1500 ASME B16.5	CARBON STEEL, STANDARD	ASME SEC.III, CLASS 3, NRC QUAL. CRP. C
D	CL 900/600 ASME B16.5	DUCTILE IRON - CEMENT LINED	ASME B31.1, (PIPE)/SMACNA (DUCT) NRC QUAL. GRP. D
E	CL 600/900 ASME B16.5	DUCTILE IRON	ASME B31.1, NON Q
F	CL 400 ASME B16.5	FERROUS, CAST IRON	NATIONAL FIRE PROTECTION ASSOCIATION CODE, FIRE PROTECTION QA
G	CL 300 ASME B16.5	CARBON STEEL, GALVANIZED	NATIONAL FIRE PROTECTION ASSOCIATION CODE
H	CL 250 ASME B16.1	COPPER - NICKEL ALLOY	
J	CL 150 ASME B16.5	PE3408/PE3608 HDPE	
K	CL 125 ASME B16.1	COPPER, BRASS OR BRONZE	
L	150 PSI, CWP	LINED PIPE	SMACNA DUCT CONSTRUCTION STANDARDS
M	125 PSI, CWP	ALUMINUM	
N	100 PSI, CWP	ALLOY 20 (UNS N08020)	
P	80 PSI, CWP	PLASTIC AND NON-METALIC	NATIONAL PLUMBING CODE
Q	NOT USED	CARBON STEEL, RUBBER LINED	
R	250 PSI, CWP	CONCRETE	ASME/ANSI AG-1 (ASME N509) DUCT STANDARD
S	200 PSI, CWP	ALLOY STEEL, HIGH STRENGTH	
T	300 PSI SERVICE (VICTAULIC PRESSFIT)	AUSTENTIC STAINLESS STEEL, HIGH STRENGTH	
U	0" - 2" W.G.	CARBON STEEL, IMPACT TESTED	
V	2" - 6" W.G.	PE4710 HDPE	
W	6" - 10" W.G.		AMERICAN WATER WORKS ASSOCIATION STANDARD
X	OVER 10" W.G.		
Y	SPECIAL USE AS SHOWN ON PIPING CLASS SHEETS	SPECIAL USE AS SHOWN ON PIPING CLASS SHEETS	SPECIAL USE AS SHOWN ON PIPING CLASS SHEETS
Z	SPECIAL USE AS SHOWN ON PIPING CLASS SHEETS	SPECIAL USE AS SHOWN ON PIPING CLASS SHEETS	APECIAL USE AS SHOWN ON PIPING CLASS SHEETS

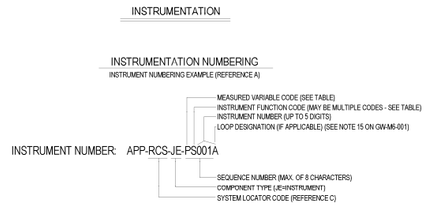
Figure 1.7-2 (Sheet 2 of 3)

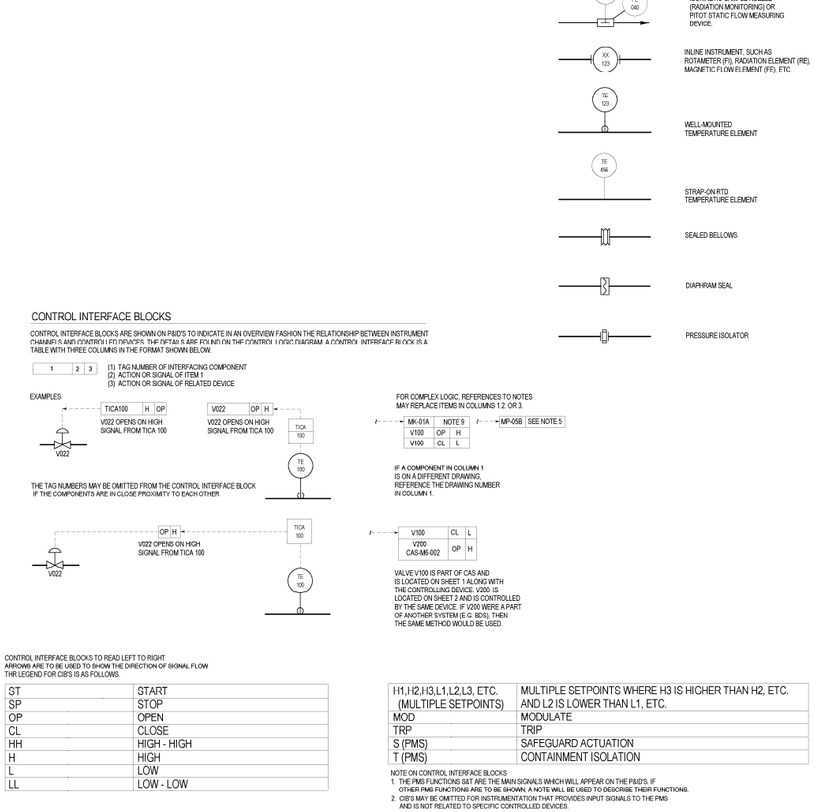
Piping and Instrumentation Diagram Legend



INSTRUMENT FUNCTION CODES

MEASURED OR INITIATED VARIABLE (1ST LETTER)	LETTER	FUNCTION CODE (2ND, 3RD, 4TH LETTER) (2)	
		LETTER	
ANALYSIS	A	A	ALARM
BURNER FLAME	B	B	USER'S CHOICE
CONDUCTIVITY	C	C	CONTROL (6)
DENSITY OR WEIGHT	D		
VOLTAGE	E	E	PRIMARY ELEMENT
FLOW	F		
GAGING (DIMENSIONAL)	G	G	LOCAL OBSERVATION GLASS
HAND (MANUAL)	H		
CURRENT	I	I	INDICATOR
POWER	J		
TIME	K	K	CONTROL STATION
LEVEL	L	L	IMDICATING LIGHTS
MOISTURE	M		
NUTRON FLUX	N		
USER'S CHOICE	O		
PRESSURE	P	P	TEST POINT CONNECTION
PRESSURE DIFFERENTIAL	PD	QI	INTEGRATING INDICATOR
QUANTITY OR EVENT	Q	Q	LOOP POWER SUPPLY
RADIOACTIVITY	R	R	RECORDER
SPEED OR FREQUENCY	S	S	SWITCH
TEMPERATURE	T	T	TRANSMITTER
TEMPERATURE DIFFERENTIAL	TD		
MULTIVARIABLE	U		
VISCOSITY	V		
WEIGHT	W		
UNCLASSIFIED	X		
VIBRATION	Y	Y	RELAY OR COMPUTER
POSITION	Z	Z	OTHER FINAL CONTROL ELEMENT

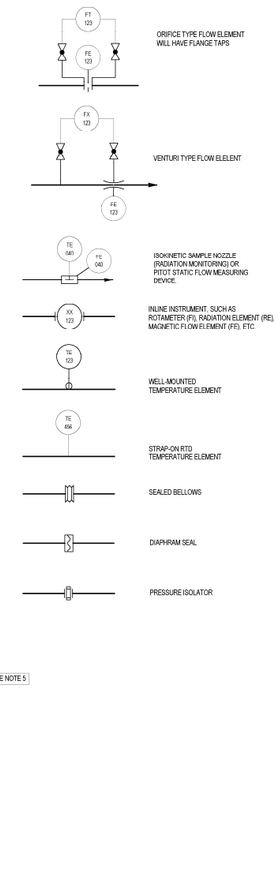


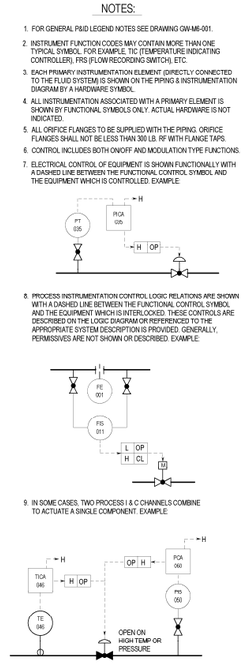


ST	START
SP	STOP
OP	OPEN
CL	CLOSE
HH	HIGH - HIGH
H	HIGH
L	LOW
LL	LOW - LOW

H1,H2,H3,L1,L2,L3, ETC. (MULTIPLE SETPOINTS)	MULTIPLE SETPOINTS WHERE H3 IS HIGHER THAN H2, ETC. AND L2 IS LOWER THAN L1, ETC.
MOD	MODULATE
TRP	TRIP
S (PMS)	SAFEGUARD ACTUATION
T (PMS)	CONTAINMENT ISOLATION

NOTE ON CONTROL INTERFACE BLOCKS
1. THE PMS FUNCTIONS S&T ARE THE MAIN SIGNALS WHICH WILL APPEAR ON THE P&IDS. IF OTHER PMS FUNCTIONS ARE TO BE SHOWN, A NOTE WILL BE USED TO DESCRIBE THEIR FUNCTIONS.
2. CIB'S MAY BE OMITTED FOR INSTRUMENTATION THAT PROVIDES INPUT SIGNALS TO THE PMS AND IS NOT RELATED TO SPECIFIC CONTROLLED DEVICES.





REFERENCE:
A. AP1000 COMPONENT NUMBERING PROCEDURE. APP-GW-GMP-006.
B. P& ID LEGEND DRAWING. APP-GW-M6-001.
C. AP1000 PLANT SYSTEM LIST, APP-GW-GEX-001.

Figure 1.7-2 (Sheet 3 of 3)

Piping and Instrumentation Diagram Legend